

Estimation of the Number of Acini during Postnatal Rat Lung Development

Wednesday, 18 September 2013 12:15 (2 hours)

Rationale: The pulmonary airways are subdivided into conducting and gas-exchanging airways. The small tree of gas-exchanging airways, which is fed by the most distal conducting airway, represents an acinus. Until now a so called dissector (five consecutive sections) was used to count lung acini. We developed a faster method and determined the number of acini throughout rat lung development.

Methods: Right middle rat lung lobes were obtained (postnatal days 4-60), stained with heavy metals or critical point dried, and scanned at TOMCAT beamline or with a micro CT (Skyscan 1172), respectively. The acini were counted in the resulting 3D-stacks of images by scrolling through them and counting every acinus per lobe using morphological criteria (thickness of epithelium and appearance of alveoli) for the detection of the transitory bronchioles (entrance of an acinus).

Results: Our method appeared to be reliable and relatively fast. Between postnatal days 4-60 the number of acini per lung stayed constant (5747 ± 518 , $p < 0.1$). A mean airspace acinar volume of 0.053, 0.142, 0.270, 0.302, and 0.910 μl were estimated at postnatal days 4, 10, 21, 36, and 60, respectively.

Conclusion: We conclude that the acini are laid down latest at the end of the saccular stage (before postnatal day 4) and that the developmental increase of the lung volume is achieved by an increase of the acinar volume and not by an increase of the number of acini.

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Session Classification: Poster session I and lunch